Flux by Cloud Type (FluxByCldTyp) Product Update

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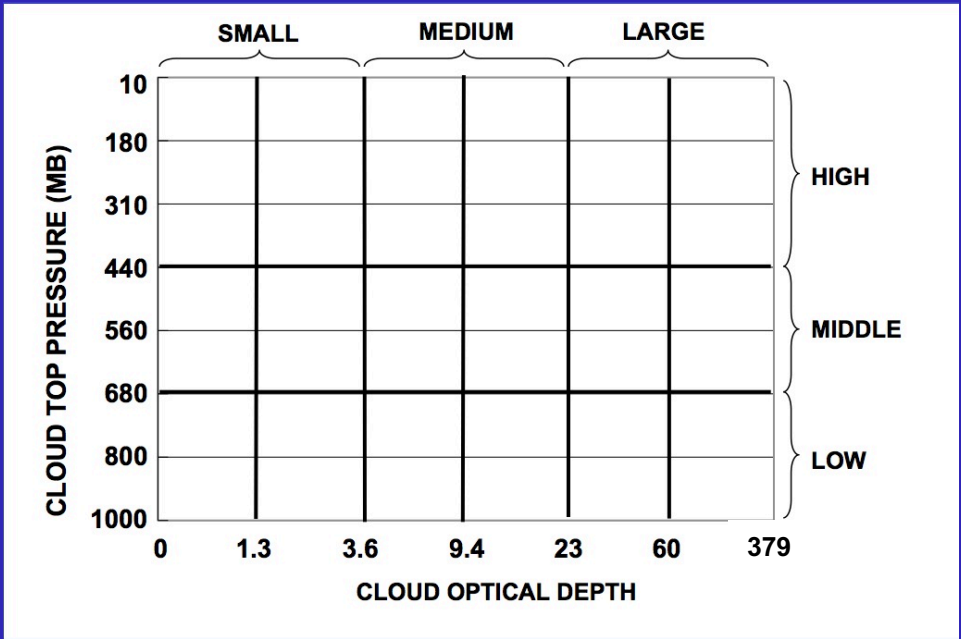
CERES Science Team Meeting

LBNL Berkeley, October 29, 2019

Outline

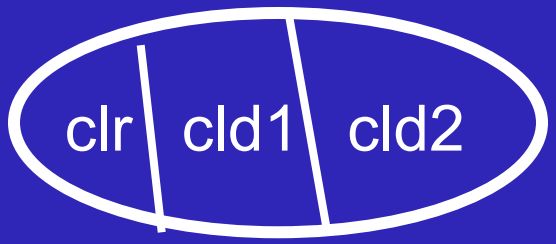
- FluxByCldTyp (FBCT) product description
- Beta Tester Results
  - Cloud fraction difference vs. Goddard
  - SW Radiative Kernels
- FluxByCldTyp Product Update
- Future work and Timeline to release

Flux by Cloud Type (FluxByCldTyp) Data



- A daytime dataset that stratifies CERES observed fluxes and MODIS cloud properties from the SSF data into 42 cloud type bins based on cloud optical depth (tau) and cloud effective pressure.
- **Motivation**: To provide the community a data set with both radiative fluxes and cloud properties by cloud type for modeling and observational studies.

CERES SSF Footprint Structure

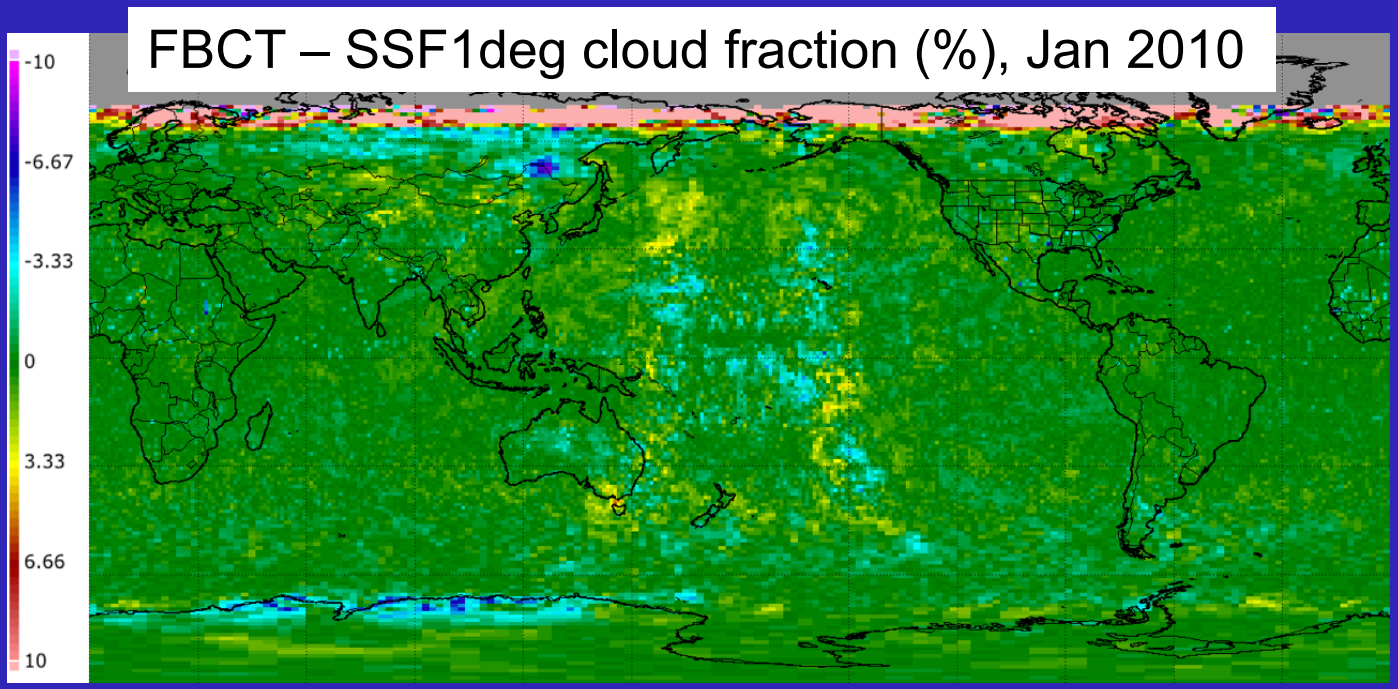


- CERES footprint size: 20km nadir
- The footprint is divided into Clear, Cloud Layer 1, Cloud Layer 2 areas (sub-footprint), based on MODIS pixel level (2km resolution) cloud properties
- Compute the Broadband flux for each sub-footprint area from the MODIS channel radiances. NB to BB coefficients based on full coverage footprints
- Normalize the computed footprint flux with the observed flux
- Stratify fluxes by Pc-Tau

Aim: To obtain flux for each of the three sub-footprint areas: clear, lower cloud and upper cloud.

Cloud fraction differences between CERES and Goddard

- The cloud mask fraction = retrieved + no-retrieved fraction
- CERES cloud code minimizes the number of no retrievals. Needed for ADM selection, otherwise must use neural network ADMs

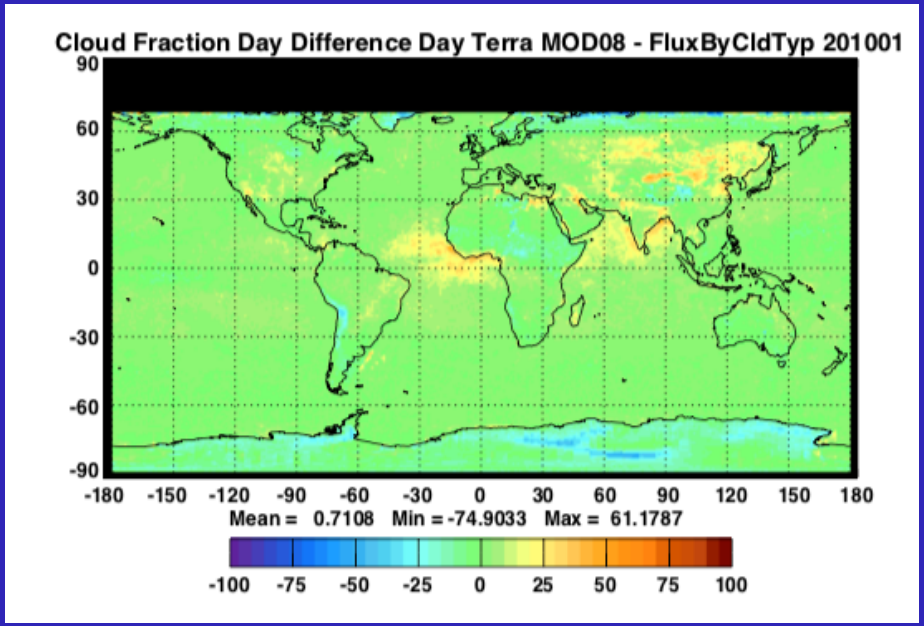


Mean=0.3%
sigma=3.3%

FBCT relies on retrieved clouds

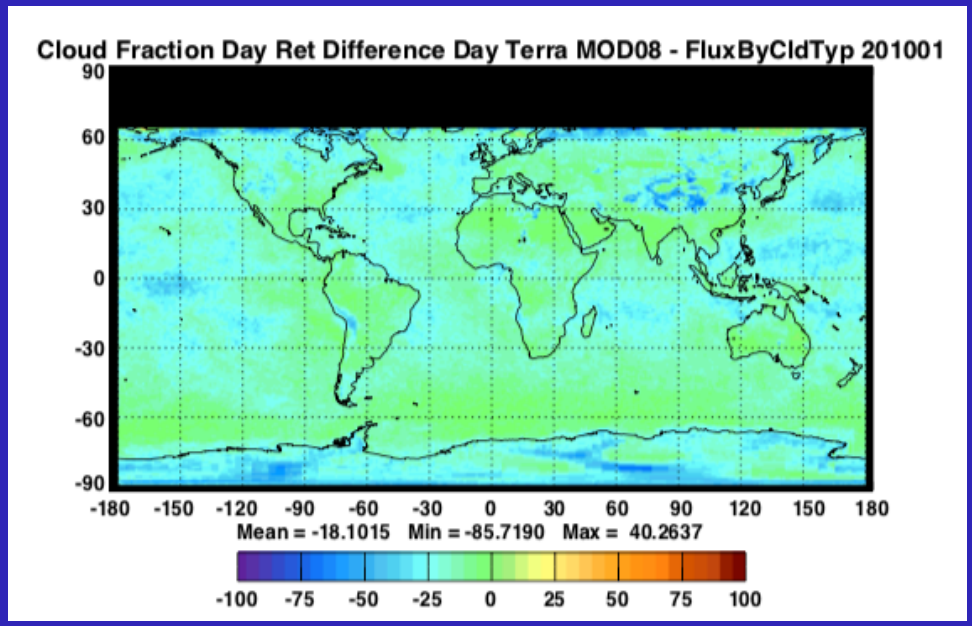
Cloud fraction differences between CERES and Goddard

MOD08(Terra) – FBCT(Terra) cloud fraction (%), Jan 2010



Mean = 0.7%

MOD08(Terra) – FBCT(Terra) retrieved fraction (%), Jan 2010

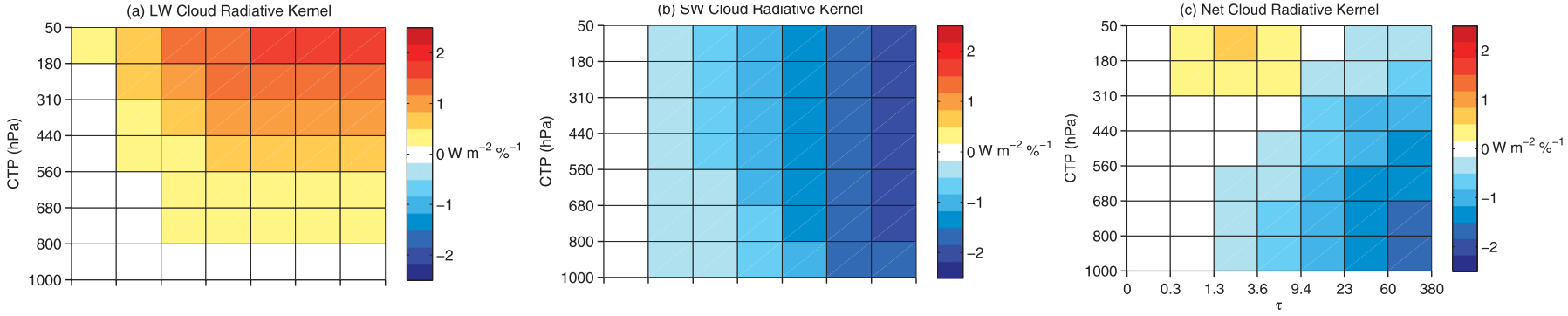


Mean = -18%

FBCT relies on retrieved clouds

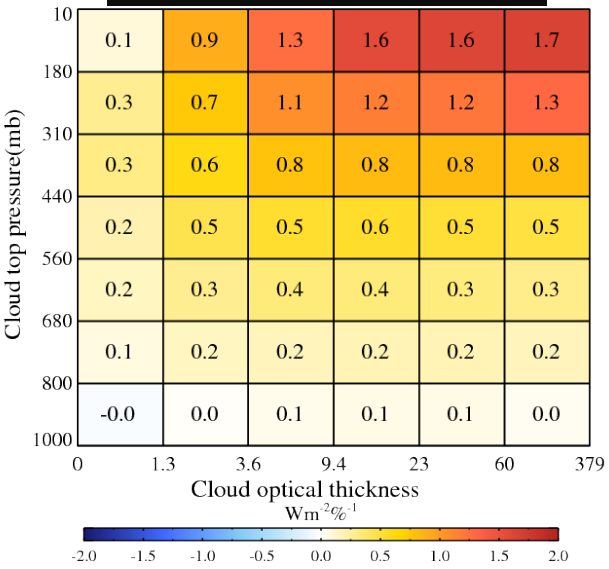
Kernels by cloud type

Zelinka Model

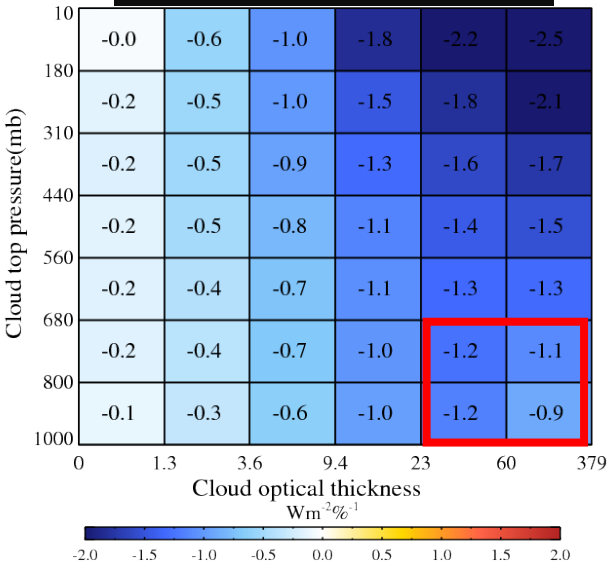


Oreopoulos FluxByCldTyp data

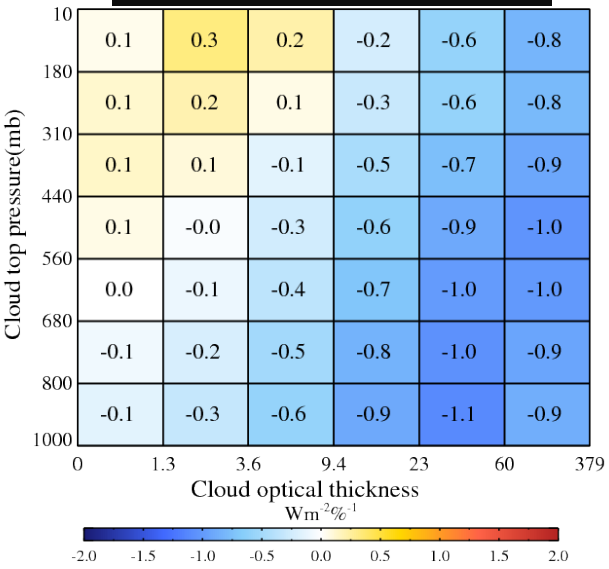
LW Cloud Radiative Kernel



SW Cloud Radiative Kernel



Net Cloud Radiative Kernel

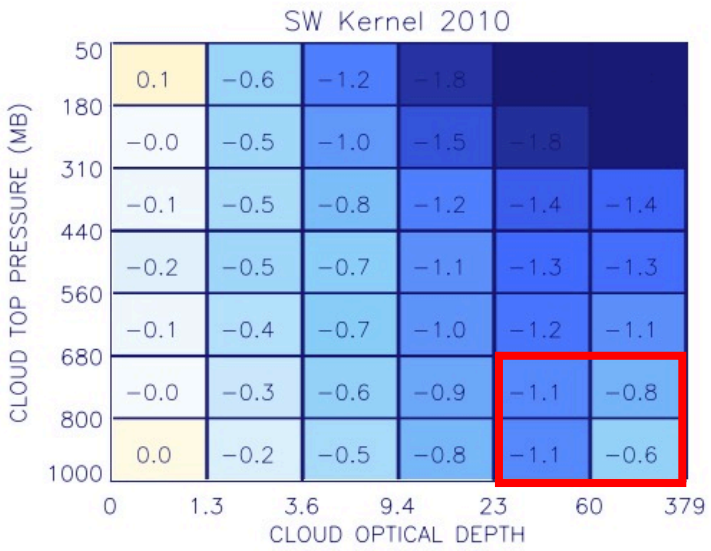


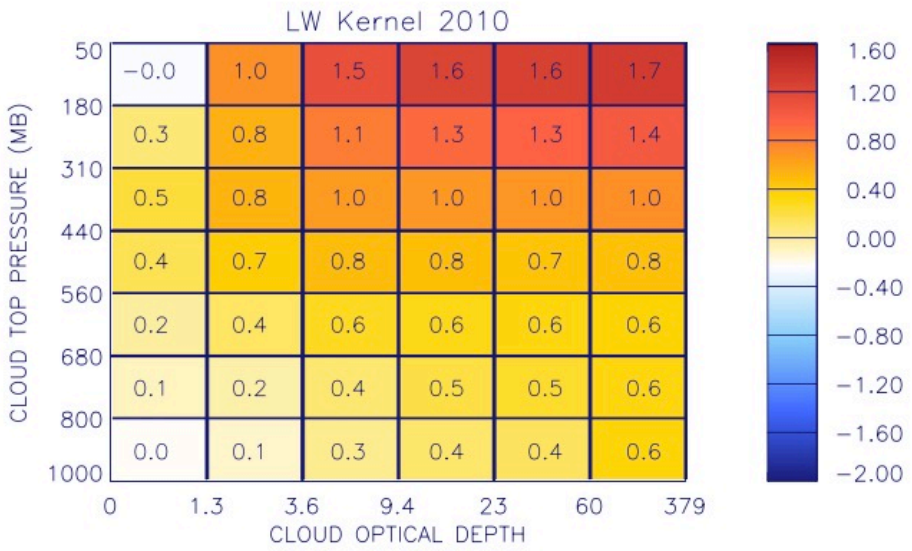
Kernel Unit: Wm^{-2}%$^{-1}$

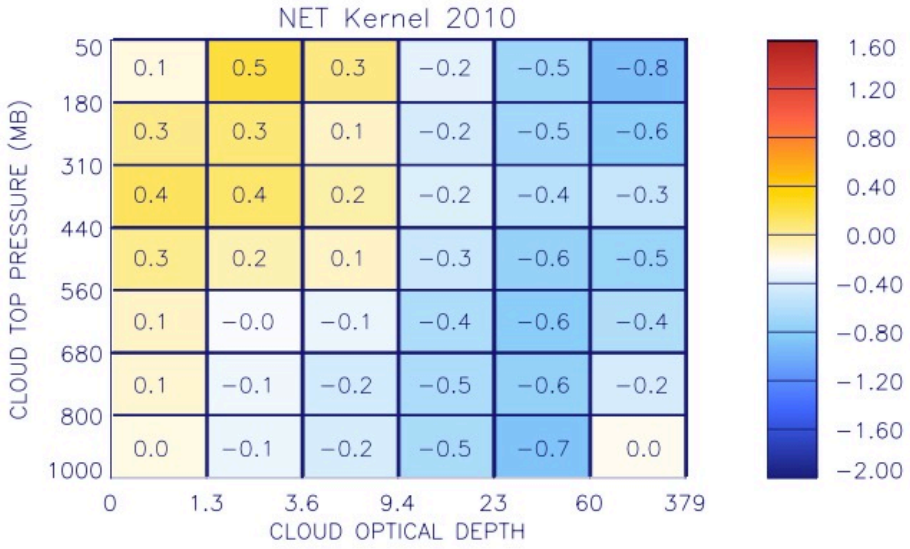
$$R = \frac{CRE}{100}$$

By Oreopoulos

Kernels by cloud type (2010 Annual Global)



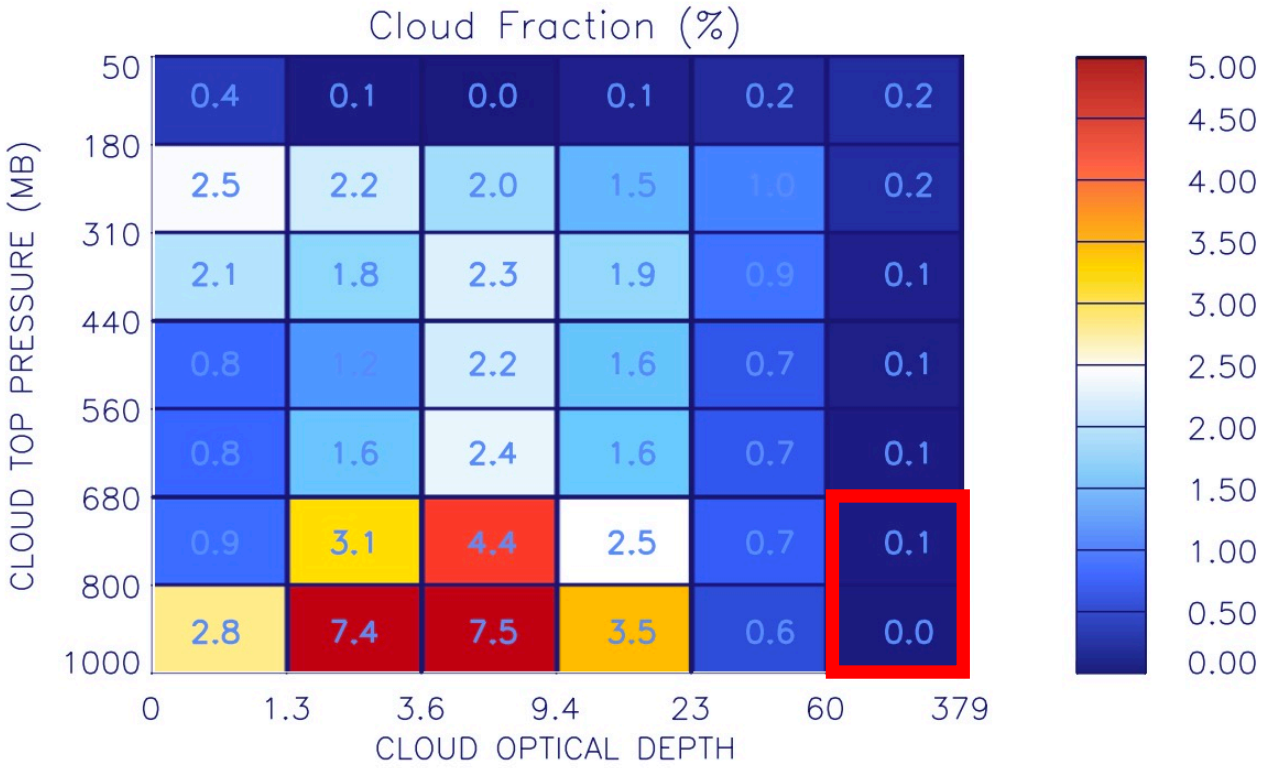




Kernel Unit: $Wm^{-2}\%^{-1}$

$$R = \frac{CRE}{100}$$

FBCT Cloud Fraction
2010 Annual Global Mean



Total Cloud Fraction = 66.7%

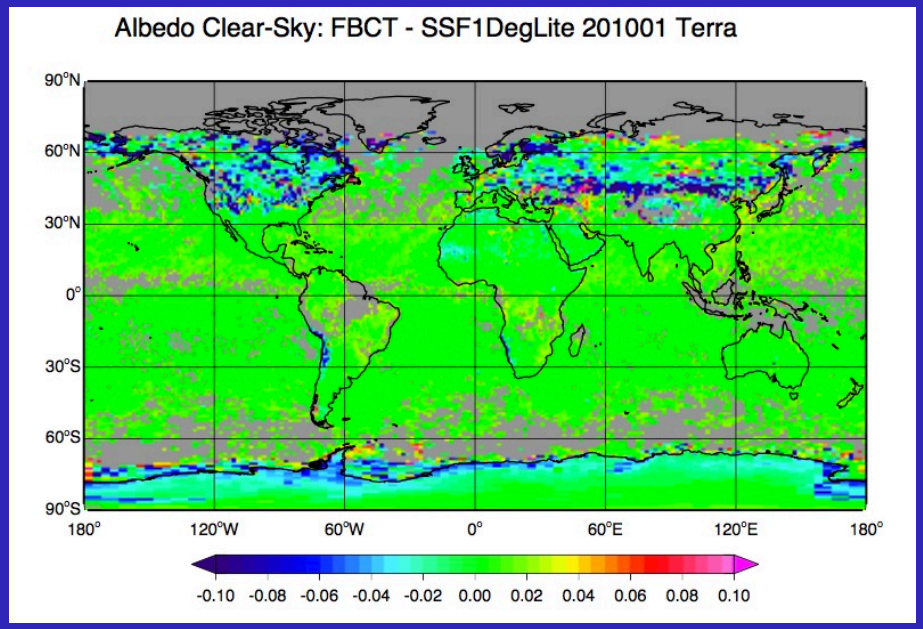
Very small amount of Clouds occur at high SZA over polar regions, unreliable cloud retrieval.

FBCT Product Update

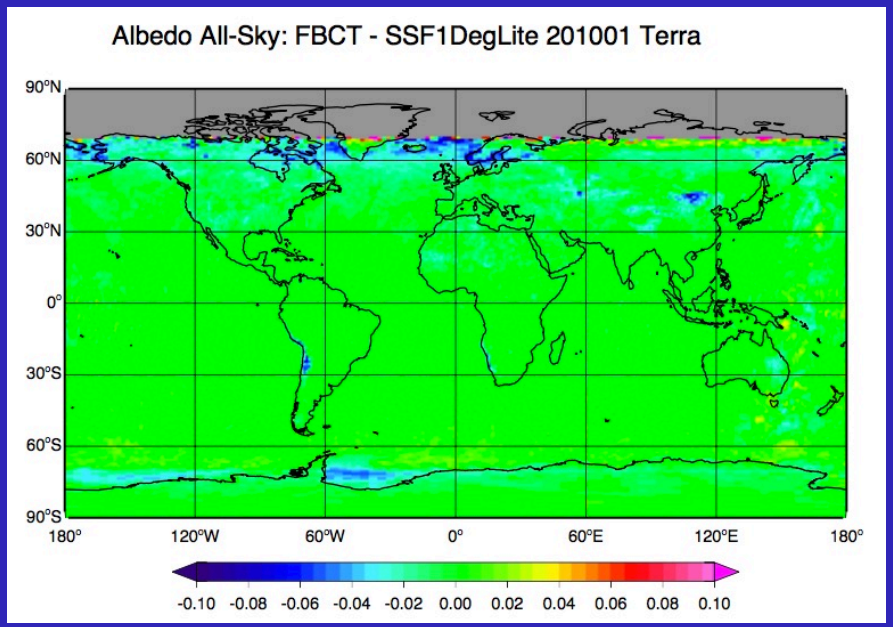
- Add albedo to parameter list
- FBCT is a daytime product
  - Limit SZA to 82°, consistent cloud retrievals
  - no-twilight retrievals
- Add daily product
  - Both daily and monthly to be publicly released
  - Both datasets will have the same parameters

Albedo
FBCT vs SSF1Deg 201001 Terra-only

Clear Sky

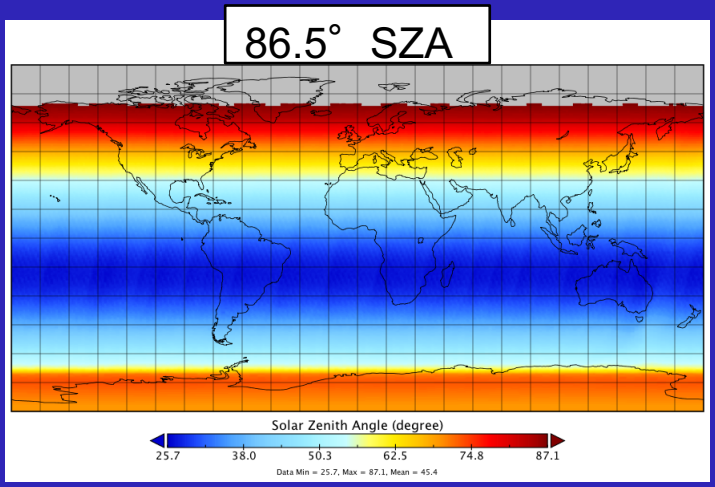


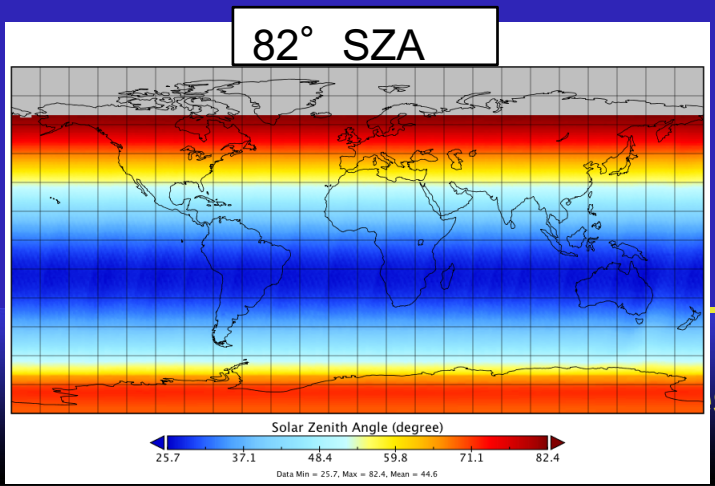
All Sky

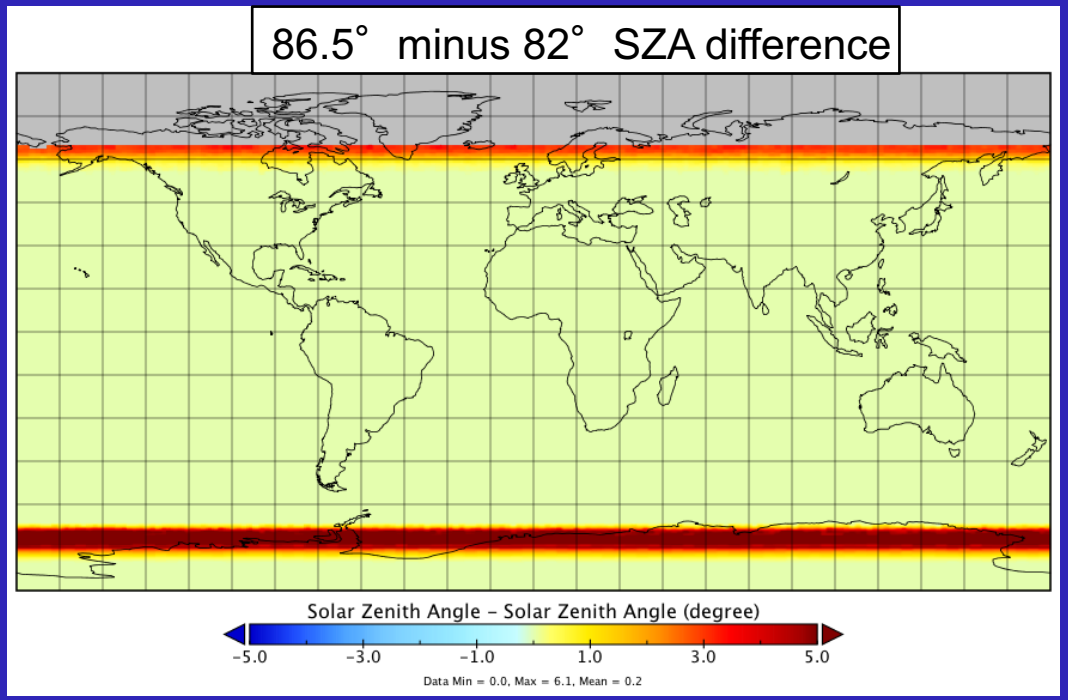


SZA 82° vs 86.5° Fluxes
Jan 2010 Terra

- 86.5° is the limit for CERES footprint observed SW fluxes
- 82° is the limit for daytime retrieved cloud properties
- Validate the results against 86.5° to make sure algorithms are consistent

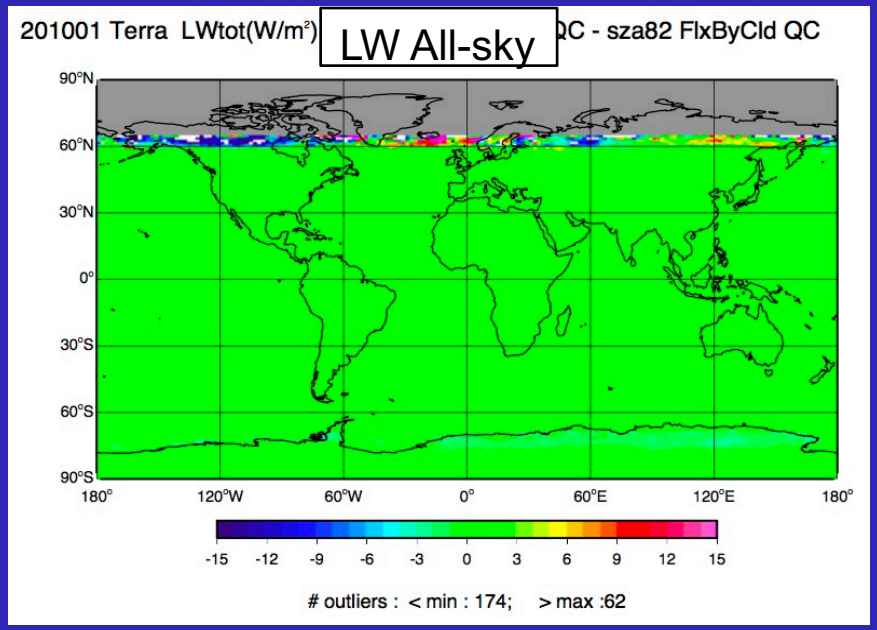


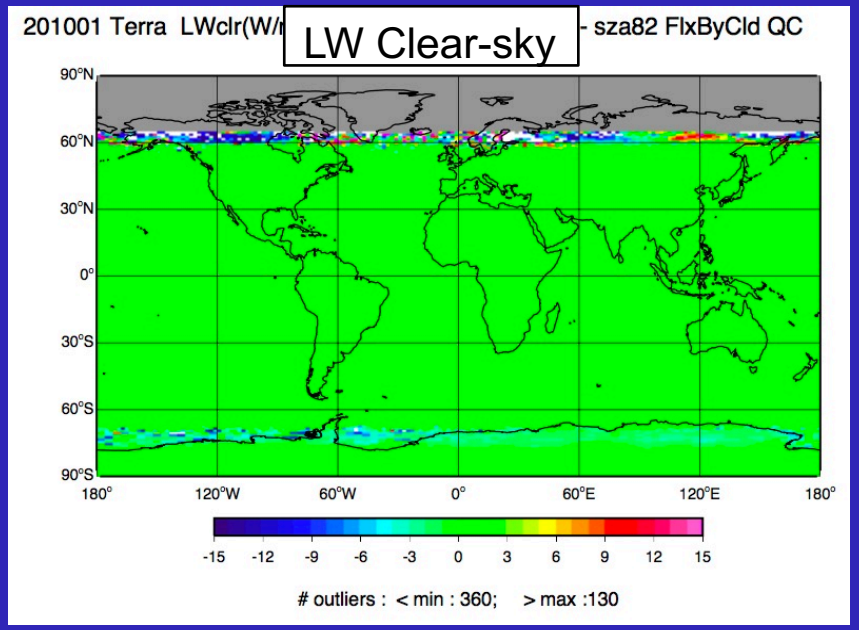


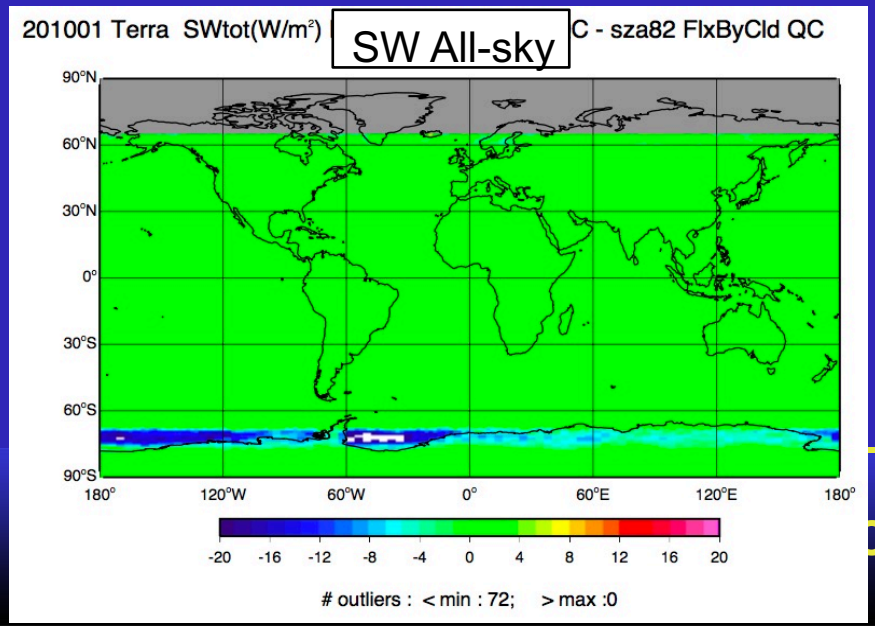


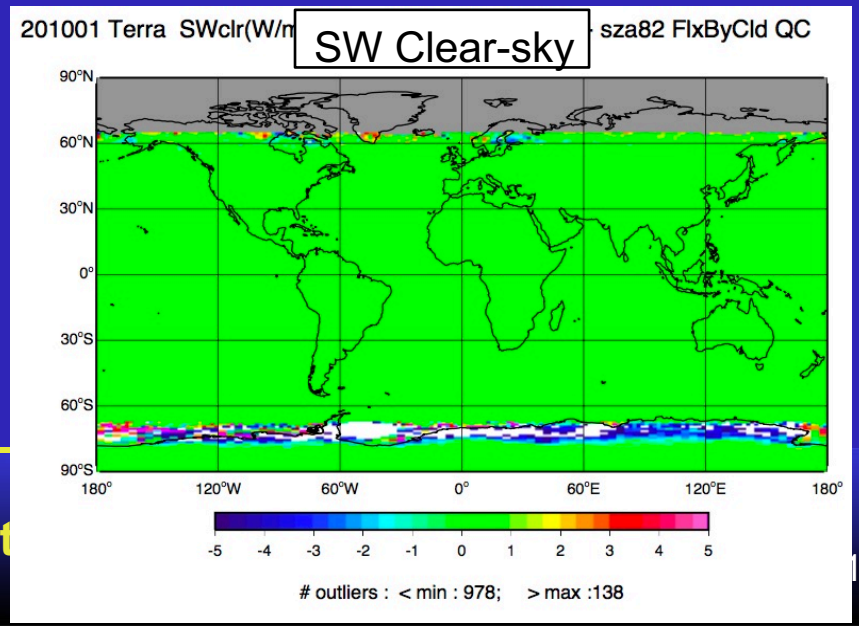
Minimal difference except for terminator and band before 24-hour illumination

SZA 82° vs 86.5° fluxes
Jan 2010 Terra



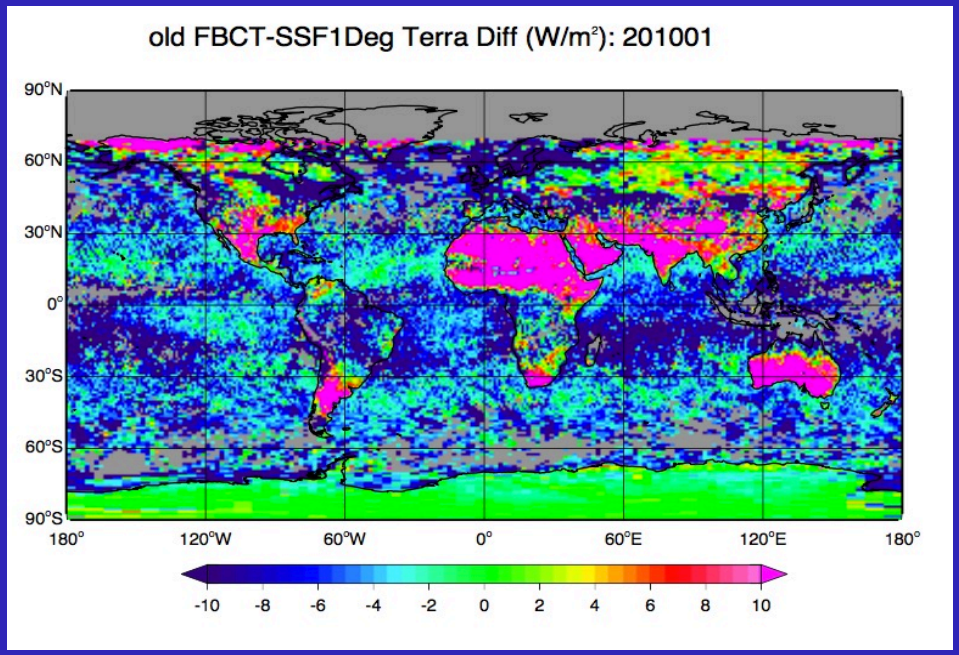






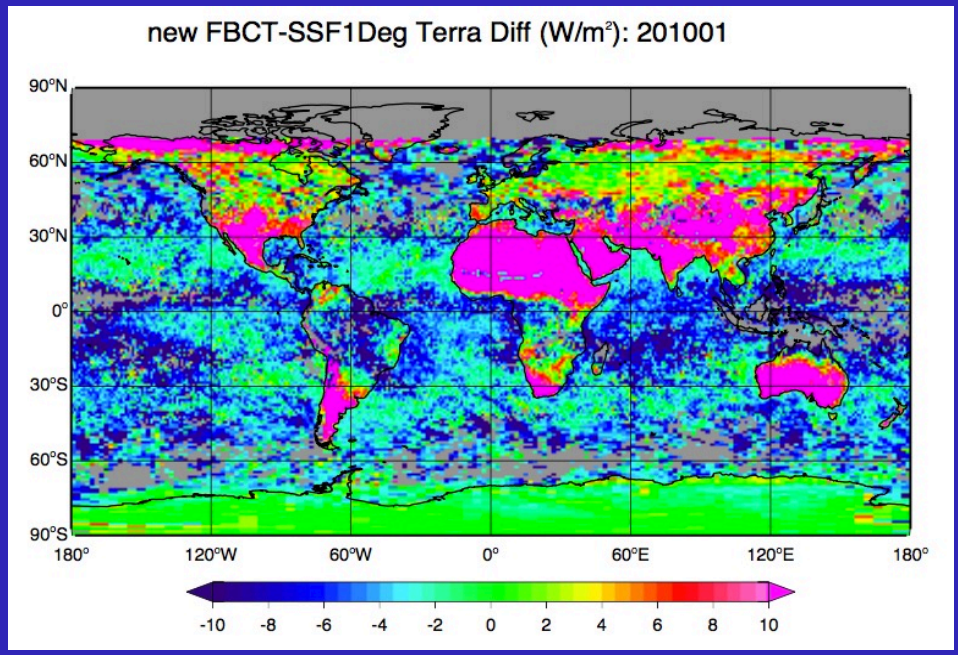
LW Clear Sky Issue

Before



Mean = -4.8W/m²

After



Mean = -1.2W/m²

Future Work and Timeline

- Improve LW Clear Sky fluxes by reducing possible cloud contamination similar to EBAF filter
- The entire record will be run and validated before delivery. (end Nov 2019)
  - Set up on CERES sub-setter for validation
- 6 weeks to implement FBCT at the DAAC and run dataset
- Publicly release (end Jan. 2020)

Thank you!

For more information:
https://ceres.larc.nasa.gov/